

REMARKS

Claims 1, 5, 7-10, 22-23, and 26-27 have been amended to more clearly define Applicant's invention. Claims 20 and 21 have been cancelled in view of these amendments. In this way, claims 1-19 and 22-30 relate to an embodiment of the invention in which the functional group of both the modified pigment and of the polymer is anionic and the salt comprises a polyvalent cation. Furthermore, new claims 31-50 have been added, and these claims relate to an embodiment of the invention in which the functional group of the modified pigment and of the polymer is cationic and the salt comprises a polyvalent anion. The amendments as well as the new claims are supported by the present specification and claims as originally filed, in particular, paragraph [0045]. No new matter has been added. Thus, claims 1-19 and 22-50 are pending.

In an Advisory Action mailed September 27, 2004, the Examiner states that Applicant's response filed July 29, 2004 has been fully considered and has overcome the rejections of record utilizing Yu et al. (U.S. Patent No. 6,494,943) as set forth in paragraph 6 of the Office Action mailed January 29, 2004. However, with respect to the remaining rejections of record, the Examiner believes the previous response is not persuasive.

Suzuki et al. (U.S. Patent No. 6,153,001)

On page 2 of the Advisory Action the Examiner summarizes Applicant's previous comments regarding Suzuki et al. The Examiner states that Applicant had argued that Suzuki et al. does not disclose an ink having the specific combination of modified pigment having attached at least one functional group and a polyvalent salt of the present claims. The Examiner further states that Applicant had argued Suzuki et al. has no disclosure that any of the pH agents, in particular the two that can be classified as salts having a polyvalent ion, should or could be used in combination with any of the modified pigments. Finally, the Examiner states that Applicant had argued that Suzuki et al. teaches against the presently claimed combination of modified pigment and polyvalent salt in light of the teaching in the

reference of fixing agents that bind functional groups of the pigment when the ink is used with an aqueous tracing solution and that, given that the fixing agent is identical to the polyvalent salt utilized in the present invention, the use of this combination would not be a viable ink since the salt would act as a fixing agent for the ink, causing destabilization of the ink.

In response, the Examiner states that Suzuki et al. explicitly discloses using modified pigment having cationic functional group and salt having polyvalent anion. The Examiner concludes that an ink comprising both modified pigment and polyvalent salt is clearly encompassed by the disclosure of Suzuki et al. Furthermore, the Examiner states that Suzuki et al. discloses only 3 types of hydrophilic functional groups (nonionic, cationic, and anionic) and also discloses the use of 3 types of pH regulating agents (acids, bases, and pH buffers, wherein salts having polyvalent anion are 2 of the pH buffers). The Examiner concludes that, since Suzuki et al. discloses a small number of modified pigments from which to choose the claimed pigment and a small number of pH regulating agents from which to choose the claimed salt, the presently claimed combination of modified pigment and salt is properly disclosed by Suzuki et al. The Examiner also notes that, while there are no examples in Suzuki et al. that utilizes the combination of the present claims, a fair reading of the reference as a whole clearly discloses that the inks of Suzuki et al. encompass those comprising both modified pigment and salt as presently claimed. Finally, regarding the teaching of fixing agents in Suzuki et al., the Examiner states that these fixing agents are not utilized in the ink of Suzuki et al. and that the salts that are utilized in the ink are different than the disclosed fixing agents, with no evidence that they would in fact function in the same manner as the fixing agents. The Examiner concludes that, given that Suzuki et al. itself discloses ink comprising both modified pigment and salt having polyvalent anion, it is clear that modified pigment and polyvalent salt can both be successfully used together in an ink composition without destabilization occurring.

Applicant respectfully disagrees. Regarding claims 1-19 and 22-30, as amended, each of these claims relate to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer comprising at least one

functional group. The functional group of the modified pigment and of the polymer is capable of coordinating with said polyvalent ion and is anionic. The salt comprises a polyvalent cation.

By comparison, Suzuki et al. describes an ink jet recording ink comprising a self-dispersing pigment having a surface functional group such as hydrophilic solubilizing groups which are nonionic, cationic, or anionic (see column 7, lines 35-39). Suzuki et al. also describes that, if necessary, pH regulating agents may be used in the ink composition (see column 13, line 16). These may be acids, bases, or pH buffers, and, of these broad categories, two are salts having polyvalent anions. There is no disclosure in Suzuki et al. of any polyvalent cationic salts. Therefore, Suzuki et al. does not disclose an ink composition comprising a pigment having an anionic surface group in combination with a salt having a polyvalent cation. Applicant therefore believes that claims 1-19 and 22-30 are not anticipated by Suzuki et al.

Regarding claims 31-50, each of these claims relate to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer comprising at least one functional group. The functional group of the modified pigment and of the polymer is capable of coordinating with said polyvalent ion and is cationic. The salt comprises a polyvalent anion.

By comparison, as discussed above, Suzuki et al. describes an ink jet recording ink comprising a self-dispersing pigment having a surface functional group which are nonionic, cationic, or anionic. Suzuki et al. also describes that, if necessary, pH regulating agents may be used in the ink composition which may be acids, bases, or pH buffers. Of these two polyvalent anions are shown. Suzuki et al. also shows that the described ink jet recording inks comprise various anionic, nonionic, cationic, or ampholyric surfactants, and that anionic or nonionic surfactants are preferred (see column 10, line 50 to column 11, line 50).

However, while Suzuki et al. describes that various pigments having surface functional group may be used with various types of optional pH regulating agents and various types of

surfactants, Suzuki et al. does not disclose that a pigment having a cationic functional group and a polymer having a cationic functional group could or should be used in combination with a salt having a polyvalent anion. Rather, Applicant believes that Suzuki et al. provides a generic teaching that various classes of pigments, various classes of agents to control the pH of the ink, and various classes of surfactants can be used. There is no disclosure that any of these pH regulating agents, and, in particular, the two that can be classified as salts having a polyvalent anion, should or could be used in combination with any of the disclosed modified pigments or surfactants, particularly those having cationic functional groups. Also, none of the many Examples disclosed in Suzuki et al. provide a disclosure of a combination of a pigment and a polymer having a cationic functional group with a salt having a polyvalent anion.

Applicant believes that choosing this specific combination of pigment, polymer, and salt would not be possible based on the disclosure of Suzuki et al. since this would go against the expressed teaching of this reference. In particular, Suzuki et al. describes that the disclosed ink jet ink is traced with one or more aqueous solutions (see column 15, line 45 to column 17, line 55) either just before, just after, or at the same time as the printing of the image with the disclosed ink jet ink. The aqueous solution preferably comprises a fixing agent "which will bind a hydrophilic functional group of the pigment contained in the ink" (see column 16, lines 1-10). The fixing agent includes polyvalent metal salts (see column 16, line 60 to column 17, line 7). Applicant notes that these salts would fall into one of the three categories identified by Suzuki et al. for possible pH regulating agents (acid, bases, or pH buffers).

Therefore, according to the disclosure of Suzuki et al., combinations of salts having polyvalent ions, particularly those shown as pH regulating agents, and modified pigments comprising a pigment having attached at least one functional group that are capable of coordinating with the polyvalent ion would not be a viable ink. The salt having the polyvalent ion would act as a fixing agent for this ink. Since fixing agents are described as being able to suppress the penetration of a colorant in an ink, thereby obtaining a image that is firmly fixed (see column 16, lines 60-64), Applicant believes that one skilled in the art would readily

conclude that, as disclosed in Suzuki et al, salts having polyvalent ions would cause destabilization of the ink and should therefore be avoided. Thus, Suzuki et al. teaches away from the specific combinations recited in present claims 31-50.

As further evidence of this, Suzuki et al. also discloses that “increased amount[s] of Mg and Fe in the ink promotes the coagulation of the pigment” (see column 16, lines 37-38) and that it is therefore preferable that the amount of Mg and Fe in the ink be extremely low. These same polyvalent metal salts are listed as examples of fixing agents. Thus, as disclosed in Suzuki et al, these polyvalent salts would act as fixing agents and would cause the coagulation of modified pigments in the ink. This teaches away from the disclosure of the present invention, in which at least one salt having a polyvalent ion and a pigment having attached at least one functional group that is capable of coordinating with the polyvalent ion, are used together.

Applicant therefore believes that the specific combination of components recited in present claims 31-50 are not encompassed by the disclosure of Suzuki et al. since choosing this specific combination would go against the expressed teaching of this reference. Thus Applicant believes that claims 31-50 are not anticipated by Suzuki et al.

Therefore, Applicants believe that, as amended, claims 1-19 and 22-50 are not anticipated by Suzuki et al.

WO 96/18695 in view of Lin (U.S. Patent No. 5,997,623)

On page 5 of the Advisory Action, the Examiner summarizes Applicant's previous comments regarding WO 96/18695 in view of Lin. The Examiner states that Applicant had argued that there is no motivation to combine these references given that there is no disclosure in WO 96/18695 or Lin of polyvalent salt and modified pigment as presently claimed given that there is no disclosure in WO 96/18695 of salt having a polyvalent ion and no disclosure in Lin of modified pigment having functional group that is anionic or cationic and that should or could be used with salt comprising polyvalent cation or salt comprising polyvalent anion, respectively, as claimed. The Examiner also states that Applicant had argued

that Lin discloses salts having polyvalent ions are used in ink that is printed next to a pigment based ink that is stabilized by an anionic dispersant wherein there is interaction between the ink, polyvalent ion, and anionic dispersant in the second ink, and that one would not use a salt having a polyvalent ion in an ink having modified pigment since it is expected that destabilization would occur.

In response, the Examiner states that, while it is agreed that there is no disclosure in WO 96/18695 of a salt having a polyvalent ion, this is why this reference is used in combination with Lin, which is also drawn to ink jet inks, and discloses the use of salts having a polyvalent cation and further discloses that the motivation for using such salts is to produce inks with the desired conductivity and reduced intercolor bleed. The Examiner also notes that Lin does disclose that pigments having anionic functional groups are utilized in the ink. The Examiner concludes that, given that Lin discloses using salt having polyvalent ion in ink jet inks in order to produce ink with desired conductivity and to produce ink which exhibits reduced intercolor bleed, it would have been obvious to one of ordinary skill in the art, absent evidence to the contrary, to use the salt in the ink of WO 96/18695. The Examiner also concludes that, given that Lin utilizes the combination of modified pigment having anionic functional group and salt having polyvalent ion, it would have been obvious to one of ordinary skill in the art to also use such salt in the ink of WO 96/18695 which comprises modified pigments.

Applicant respectfully disagrees. Regarding claims 1-19 and 22-30, as amended, each of these claims relate to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer comprising at least one functional group. The functional group of the modified pigment and of the polymer is capable of coordinating with said polyvalent ion and is anionic. The salt comprises a polyvalent cation.

WO 96/18695 discloses an aqueous ink jet ink comprising an aqueous vehicle and a modified carbon product comprising carbon having attached at least one organic group. The

organic group comprises at least one ionic or ionizable group. A variety of additives, including polymers having functional groups, may be added. However, there is no disclosure of the use of a polyvalent salt, in particular, a salt having a polyvalent cation, in combination with any modified carbon product and polymer, in particular, those having anionic functional groups.

Lin describes an aqueous ink jet ink comprising water, a colorant such as a dye or a pigment, and a diol derivative having a specified formula. Pigment particles, such as those modified chemically to possess ionizable functional groups in water, including anionic groups, can also be used. Lin also teaches that the ink jet ink may optionally comprise a water soluble or miscible microwave coupler, which is described as being capable of coupling with a heating device such as a microwave device for drying ink and avoiding intercolor bleeding when the inks are printed next to, for example, a pigment based ink which is stabilized by an anionic dispersant (see column 14, line 45 to column 15, line 16). Various salts for this purpose are disclosed, including salts having polyvalent cations or anions. In particular, Lin states that metal salts of monovalent and multi-valent salts can also be used in the disclosed ink jet inks for the reduction of intercolor bleeding either through microwave heating of the images or chemical interaction with anionic type colorants, including anionic dyes, pigments stabilized with anionic dispersants, pigments with anionic functional group(s) on the surface, and the like, in a multi-color ink jet printing process.

Thus, Lin clearly teaches that polyvalent salts, such as the polyvalent metal salts listed, interact with various inks containing pigments having anionic functionalities and have a destabilizing effect on these inks. The result of this interaction is a reduction of intercolor bleed (i.e., bleed near the border of two different inks). Since these salts destabilize anionic pigments, Lin further teaches the salts must be chosen so that they will not cause a latency or jetting problem especially for a high resolution printhead with a small orifice size. Only those that are compatible with the ink components may be used (see column 15, lines 17-31).

Applicant therefore believes that, based on the teaching of Lin, one skilled in the art would not combine the microwave couplers of Lin, which would be considered to be salts

having polyvalent cations, with the modified pigments of WO 96/18695 having attached anionic functionality, particularly in combination with a polymer having a anionic functionality. The only way to arrive at the present invention would be to pick and choose various aspects of the general disclosure of each reference, without any disclosure in either reference that would suggest that such combinations would be possible. Furthermore, choosing this specific combination would go against the teaching of Lin, which states that any combination of components, including the salts, would involve choosing components that would be considered compatible. As clearly taught by Lin, such a choice would not include polyvalent cationic salts and pigments having anionic functionality, including those having anionic polymeric dispersants. Therefore, Applicant believes that claims 1-19 and 22-30 are patentable over WO 96/18695 in view of Lin.

Similarly, regarding claims 31-50, Applicant believes that these claims are patentable over this combination of references. Each of these claims relate to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer comprising at least one functional group. The functional group of the modified pigment and of the polymer is capable of coordinating with said polyvalent ion and is cationic. The salt comprises a polyvalent anion. Applicant believes that, based on the teaching of Lin, one skilled in the art would not combine the microwave couplers of Lin, which would be considered salts comprising a polyvalent anion, with the modified pigments of WO 96/18695 having attached cationic functional groups, particularly in combination with a polymer having a cationic functionality. The only way to arrive at the present invention would be to pick and choose various aspects of the general disclosure of each reference, without any disclosure in either reference that would suggest that such combinations would be possible. Furthermore, choosing this specific combination would go against the teaching of Lin, which states that any combination of components, including the salts, would involve choosing components that would be considered compatible. Since, as clearly taught by Lin, such a choice would not include polyvalent cationic salts and pigments having anionic functionality,

Applicant believes that one skilled in the art would also not choose a polyvalent anionic salt and a pigment having cationic functionality, particularly in combination with a polymer having a cationic functionality. Therefore, Applicant believes that claims 31-50 are patentable over WO 96/18695 in view of Lin.

Applicant therefore believes that claims 1-19 and 22-50 are patentable over WO 96/18695 in view of Lin.

Zhu (U.S. Patent No. 5,889,083) in view of WO 96/18695

On page 7 of the Advisory Action, the Examiner summarizes Applicant's previous comments regarding Zhu in view of WO 96/18695. The Examiner states that Applicant had argued that there is no motivation to combine the references given that it is well known in the art that salts would destabilize ionically stabilized pigments.

In response, the Examiner states Zhu discloses that "any" pigment can be used in the ink. The Examiner further states that WO 96/18695, which is drawn to ink jet inks, discloses the use of modified pigments identical to that presently claimed and further discloses that it is advantageous to use modified pigments instead of conventional pigments, as disclosed by Zhu, given that modified pigments are easier to disperse and do not require the use of a dispersant. The Examiner concludes that it is therefore proper to combine Zhu and WO 96/18695. The Examiner also states that, given that Zhu also discloses the use of polymer which is capable of coordinating with the salt having polyvalent cation, it is not clear that one of ordinary skill in the art would have recognized that addition of modified pigment would destabilize the ink of Zhu. The Examiner states that there is no evidence that such destabilization would occur in Zhu. Therefore, the Examiner concludes that the given that Zhu discloses that any pigment can be used, given that WO 96/18695 is drawn to the same field of endeavor as Zhu and discloses proper motivation for combining the references, and given that there is no evidence that the presence of salt having polyvalent ion would destabilize the ink, the combination of Zhu and WO 96/18695 is deemed proper.

Applicant respectfully disagrees. Regarding claims 1-19 and 22-30, as amended, each

of these claims relate to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer comprising at least one functional group. The functional group of the modified pigment and of the polymer is capable of coordinating with said polyvalent ion and is anionic. The salt comprises a polyvalent cation.

Zhu discloses an aqueous jet ink composition comprising water, a colorant, a binder resin, and a wax, as well as a process for preparing and printing this ink. An example of the colorant is carbon black, and an example of a binder resin is a styrene-acrylic copolymer. Zhu further teaches that the jet ink compositions may also comprise a conductivity agent. Various salts for this purpose are disclosed, of which only one - calcium chloride - can be considered to be a salt having a polyvalent cation. However, there is no teaching in Zhu of an ink composition comprising a modified pigment having attached at least one functional group, particularly an anionic functional group. Only conventional pigments are disclosed.

WO 96/18695 discloses an aqueous ink jet ink comprising an aqueous vehicle and a modified carbon product comprising carbon having attached at least one organic group. The organic group comprises at least one ionic or ionizable group. A variety of additives, including polymers having functional groups, may be added. However, there is no disclosure of the use of a polyvalent salt, in particular, a salt having a polyvalent cation, in combination with any modified carbon product and polymer, in particular, those having anionic functional groups.

However, even though both Zhu and WO 96/18695 relate to the same field of endeavor, Applicant believes that these references would not be combined by one skilled in the art, thereby arriving at the present invention. Specifically, Applicant believes that one would not replace the conventional pigments described in Zhu with the modified pigments disclosed in WO 96/18695, particularly those having attached anionic functional groups, if the aqueous jet ink of Zhu contains a polyvalent cationic salt conductivity agent such as calcium chloride. While Zhu states that any pigment that can be dispersed in the ink can be used (see column 3,

lines 26-28), there is no teaching or suggestion that any of the potential pigments can or should have attached functional groups, particularly attached anionic functional groups. None of the pigments shown in Zhu have attached functional groups. Furthermore, it is well known in the art that salts, particularly salts comprising polyvalent ions, destabilize ionically stabilized pigments. This is particularly true when a polyvalent ion is used that has a charge opposite to that of the ionically stabilized pigment. This supported by the present application and, in particular, paragraph [0046], which states that "addition of the salt may result in flocculation of the pigment". Furthermore, both Lin and Suzuki et al., referenced by the Examiner and discussed in more detail above, each describe that the presence of polyvalent salts effects the stability of an ink containing a pigment comprising attached functional groups.

One skilled in the art, in considering the teaching of Zhu, would therefore not use a modified pigment having an attached organic group in an ink composition having a polyvalent metal cation, as in Zhu, since it would be expected that destabilization of the ink would occur. Thus, even if one skilled in the art were to combine these references, Applicant believes, in order to avoid flocculation, one skilled in the art would only combine a modified pigment having an attached anionic functional group with a salt having a polyvalent anion, and would not use the calcium chloride conductivity agent disclosed in Zhu. This is clearly not the ink jet ink of the present claims.

Furthermore, while WO 96/18695 teaches various modified carbon products and Zhu teaches various conductivity agents, including one polyvalent salt (calcium chloride), that can be used in an ink jet ink, these are generic disclosures. No guidance is provided in these references, either alone or in combination, as to how to choose specific combinations of modified pigments, polyvalent salts, and polymer. More particularly, there is no teaching or suggestion that would lead one skilled in the art to combine both a modified pigment and a polymer having anionic functional group with a salt having a polyvalent cation, particularly the one polyvalent cationic salt disclosed in Zhu.

Therefore, Applicant believes that the only way to arrive at the present invention would be to pick and choose various aspects of the general disclosure of each reference, without any

disclosure in either reference that would suggest that such combinations would be possible. Applicant therefore believes that claims 1-19 and 22-30 are patentable over Zhu in view of WO 96/18596.

Regarding claims 31-50, each of these claims relate to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer comprising at least one functional group. The functional group of the modified pigment and of the polymer is capable of coordinating with said polyvalent ion and is cationic. The salt comprises a polyvalent anion.

Zhu discloses an aqueous jet ink composition comprising water, a colorant, a binder resin, and a wax, as well as a process for preparing and printing this ink. An example of the colorant is carbon black, and an example of a binder resin is a styrene-acrylic copolymer. Zhu further teaches that the jet ink compositions may also comprise a conductivity agent. While various salts for this purpose are disclosed, none of these comprise a polyvalent anion.

WO 96/18695 discloses an aqueous ink jet ink comprising an aqueous vehicle and a modified carbon product comprising carbon having attached at least one organic group. The organic group comprises at least one ionic or ionizable group. A variety of additives, including polymers having functional groups, may be added. However, there is no disclosure of the use of a polyvalent salt, in particular, a salt having a polyvalent anion, in combination with any modified carbon product and polymer, in particular, those having cationic functional groups.

Since neither reference discloses the use of a salt comprising a polyvalent anion, neither reference, either alone or in combination, teaches or suggests the ink composition of claims 31-50 which comprises a salt comprising a polyvalent anion. Thus, Applicant believes these claims are patentable over Zhu in view of WO 96/18693.

Applicant therefore believes that pending claims 1-19 and 22-50 are patentable over Zhu in view of WO 96/18695.


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Conclusion

In view of the foregoing remarks, consideration of this amendment, prompt examination and allowance of this application is respectfully requested. If, in the opinion of the Examiner, a telephone conference would further expedite the prosecution of the subject application, the Examiner is invited to call the undersigned.

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